

‘Low Redshift’ 21cm

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Dunlap Institute
@ Future Surveys
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Photo credit:
K Vanderlinde

Adrian asked me to talk about 3 things:

- ❖ Status of CHIME and HIRAX
- ❖ Challenges
- ❖ Post-LSST Experiment

Adrian asked me to talk about 3 things:

Status of CHIME and HIRAX

The Canadian Hydrogen Intensity Mapping Experiment (CHIME)



Full CHIME

- 4 cylinders: 20m x 100m ← Chosen for BAO scales
- 1024 dual-polarization feeds
- 400-800MHz ← Redshifts 0.8 — 2.5
- Constructed, currently being instrumented
- 5 year survey



The Canadian Hydrogen Intensity Mapping Experiment (CHIME)

- 4 cylinders: 20m x 100m
- 1024 dual-polarization feeds
- 400-800MHz
- Constructed, instrumented this year
- 5 year survey



Full CHIME



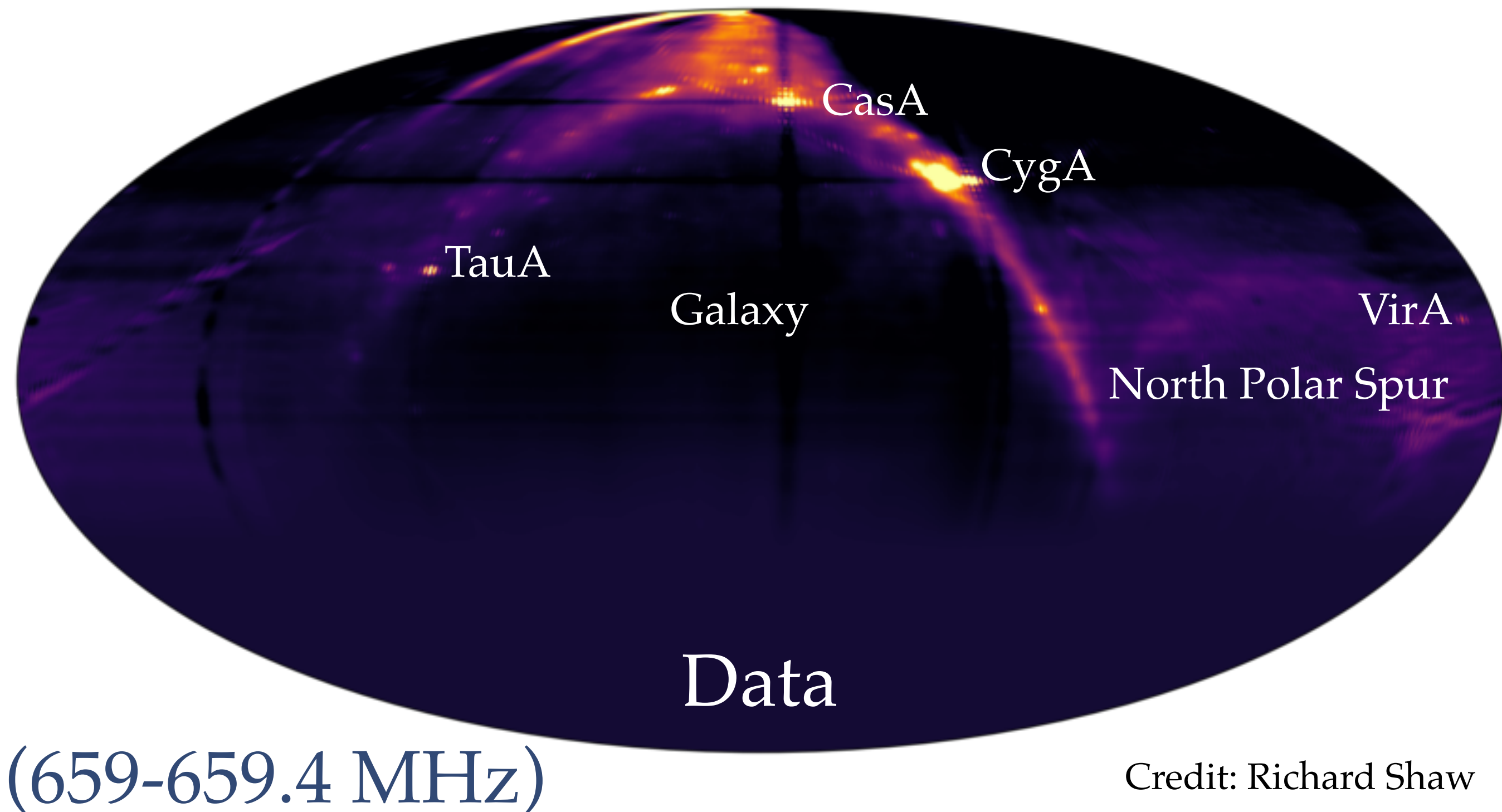
- 2 cylinders: 20m x 37m
- 128 dual-pol'n feeds
- On sky!
- 2 year survey

Pathfinder



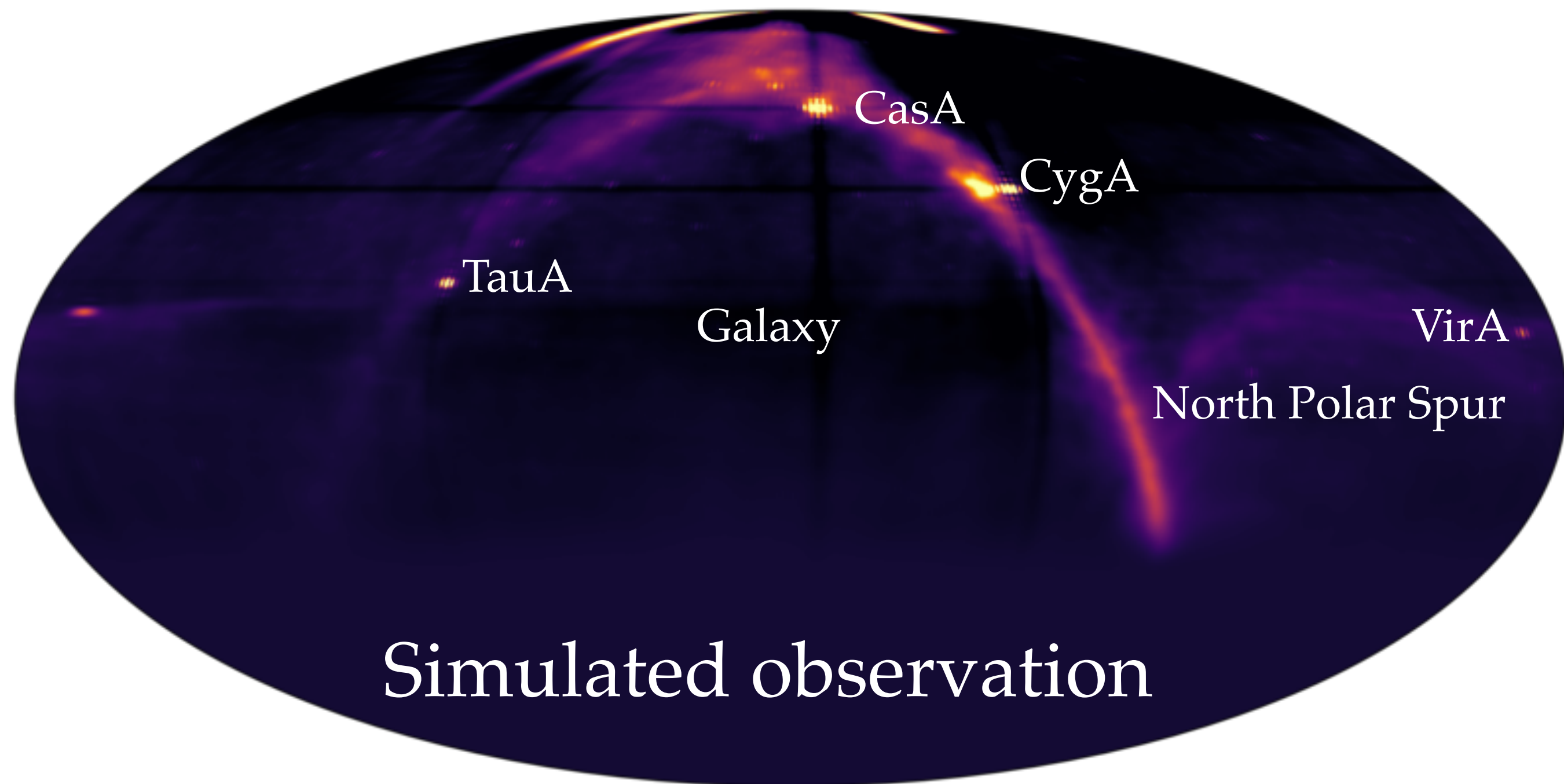
Pathfinder Preliminary map - 3/4 of the sky

x 1024 frequencies x 2 years



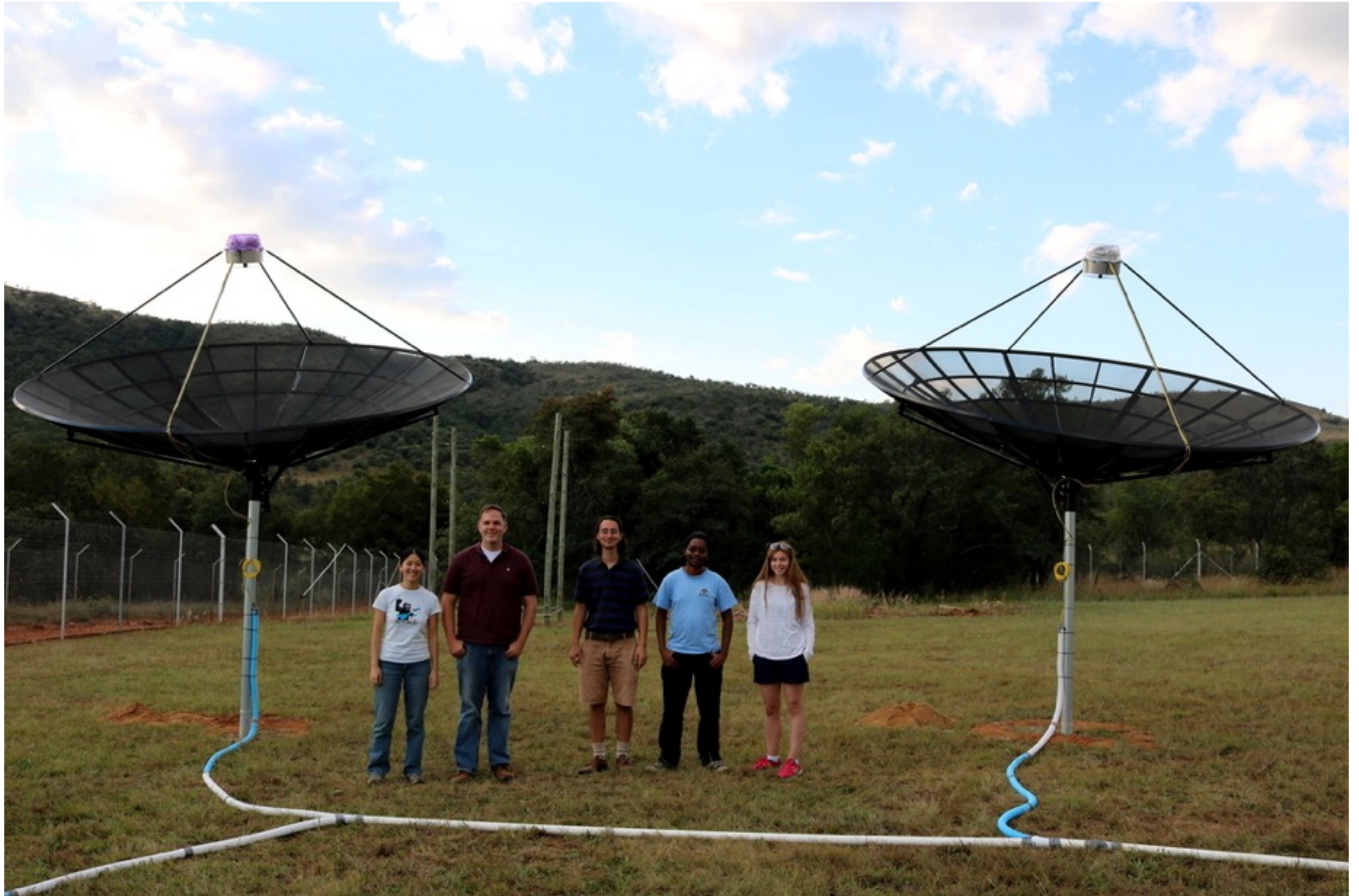
Credit: Richard Shaw

Pathfinder Preliminary map - 3/4 of the sky



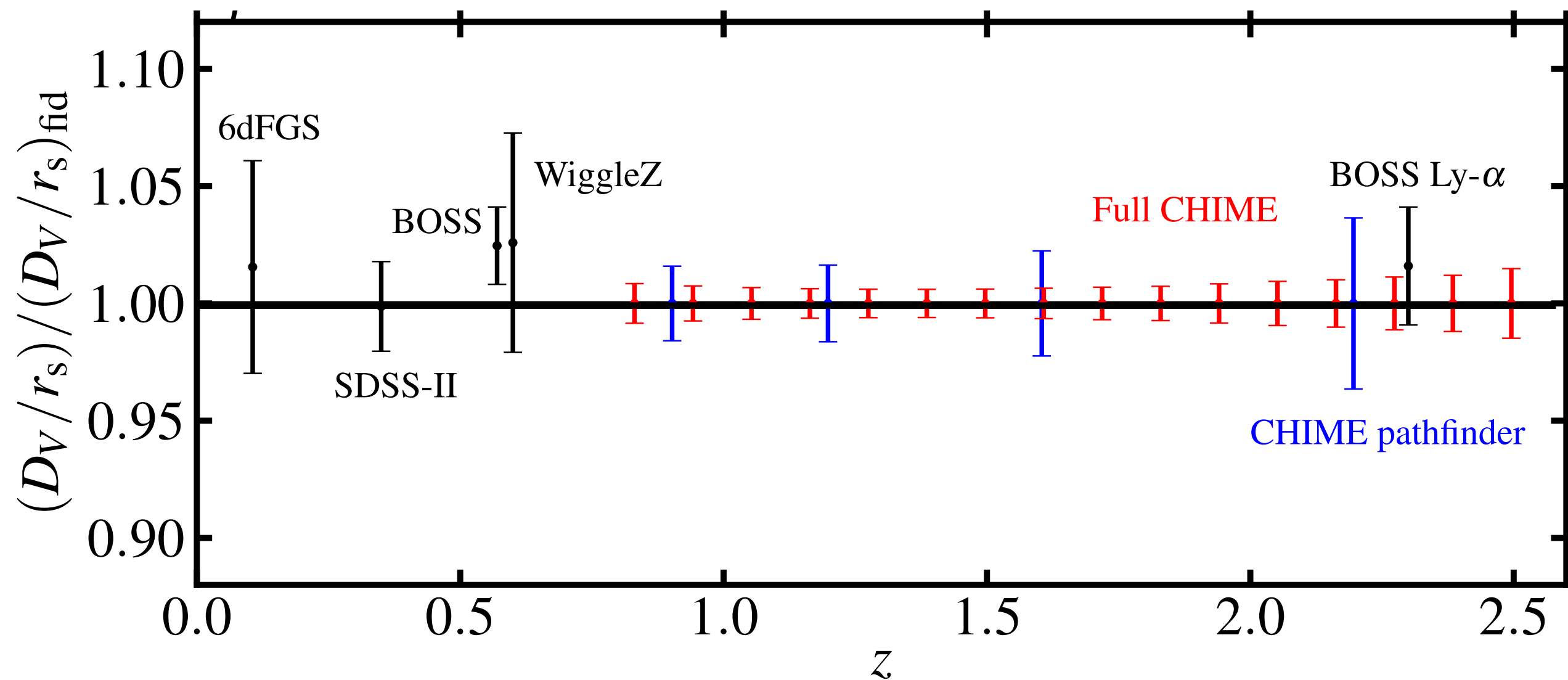
Credit: Richard Shaw

Hydrogen Intensity and Real-time Analysis Experiment (HIRAX) – prototype of a prototype



Why build CHIME?

Cosmological Distance



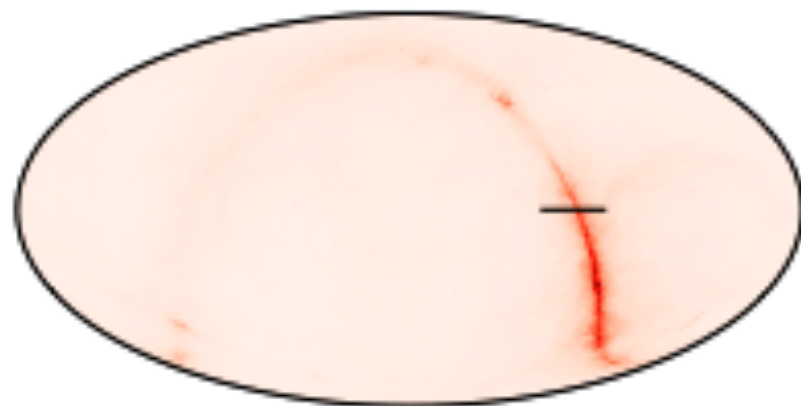
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Challenges

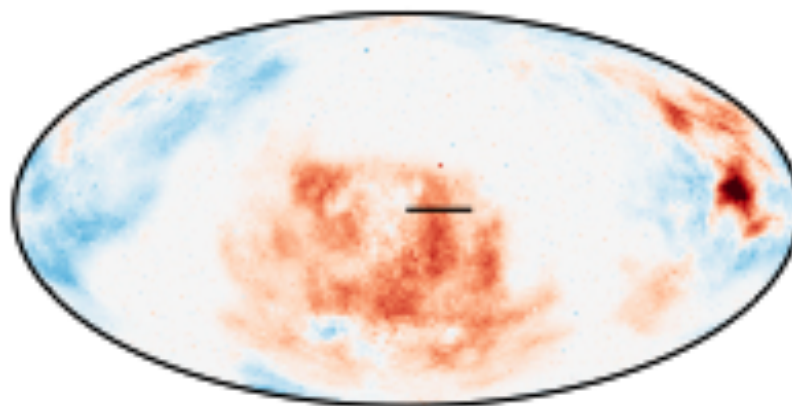
We have some ~~problems~~ challenges...

Simulated Sky

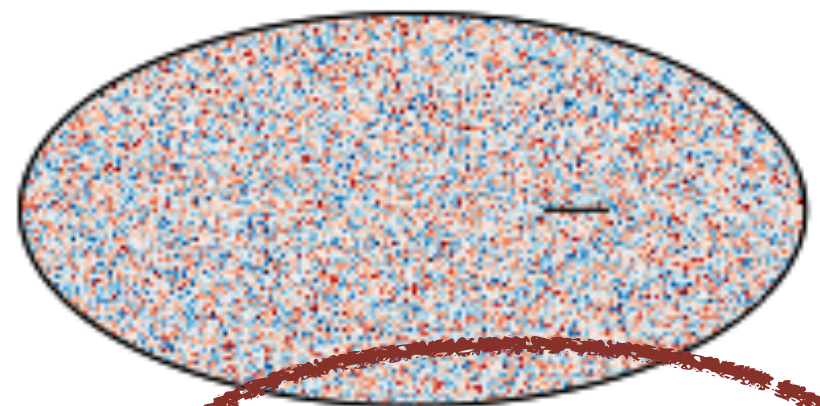
Unpolarised Foreground



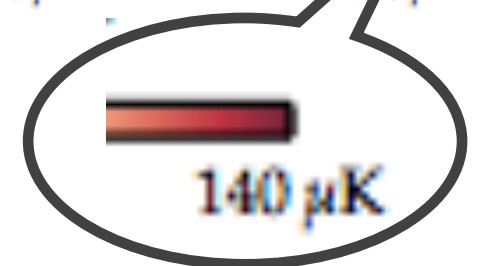
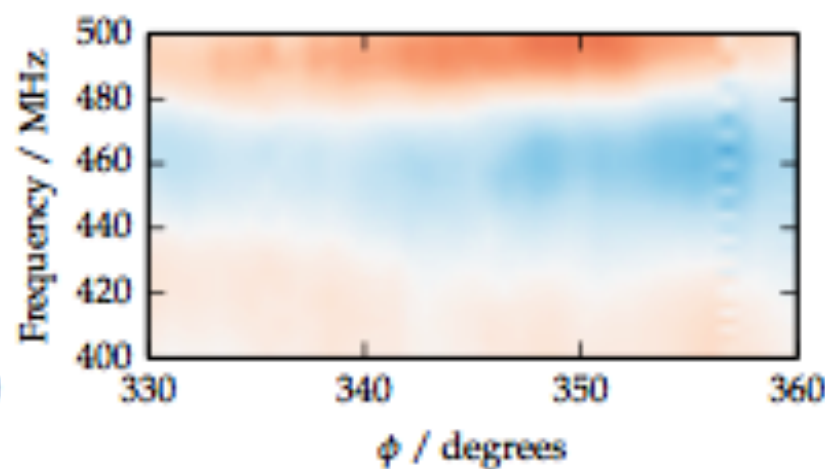
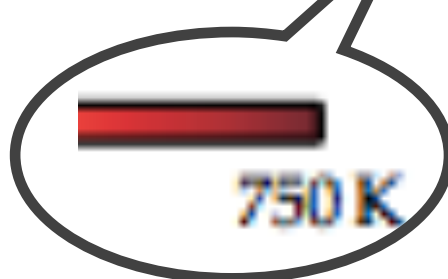
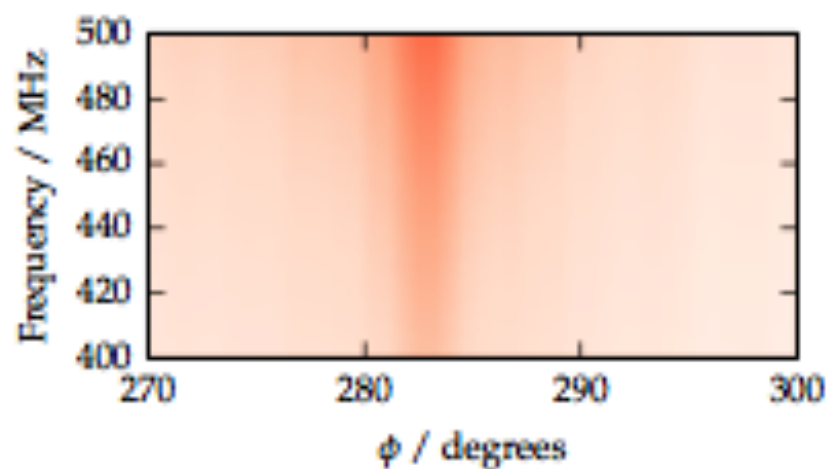
Polarised Foreground (Q)



21cm Signal



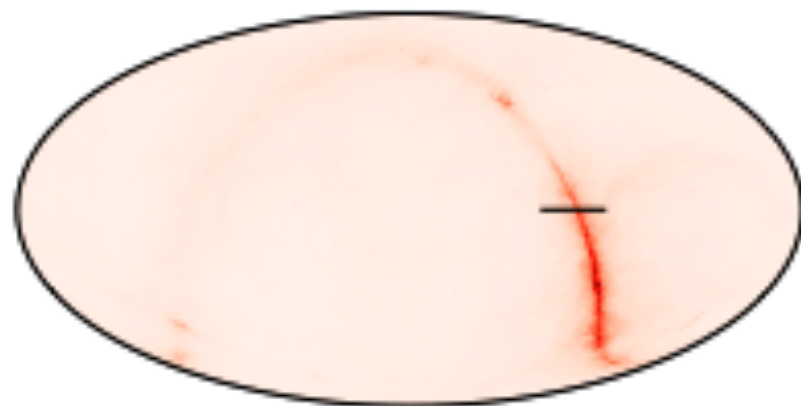
Shaw et al 1401.2095



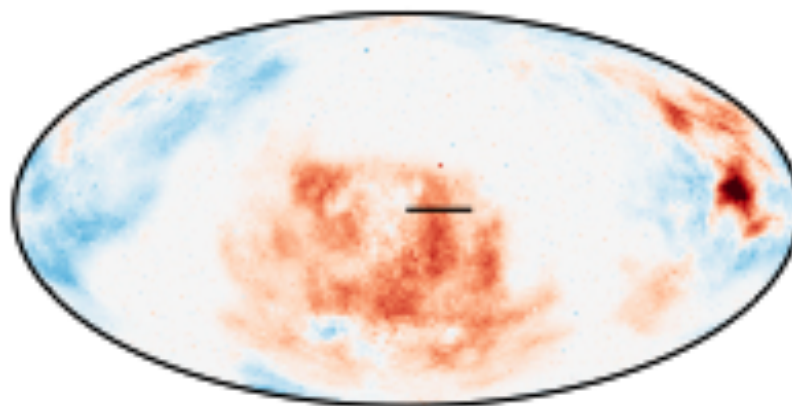
We have some ~~problems~~ challenges...

Simulated Sky

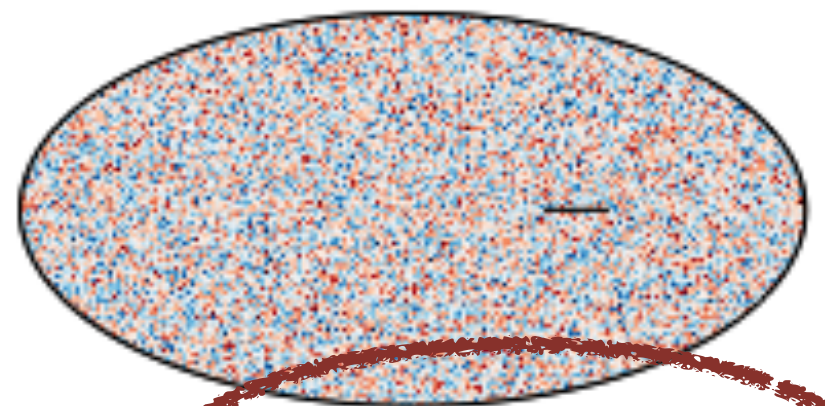
Unpolarised Foreground



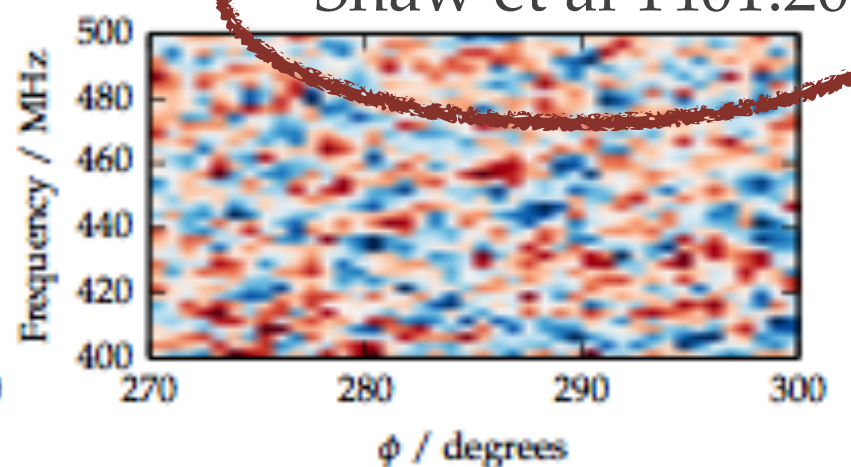
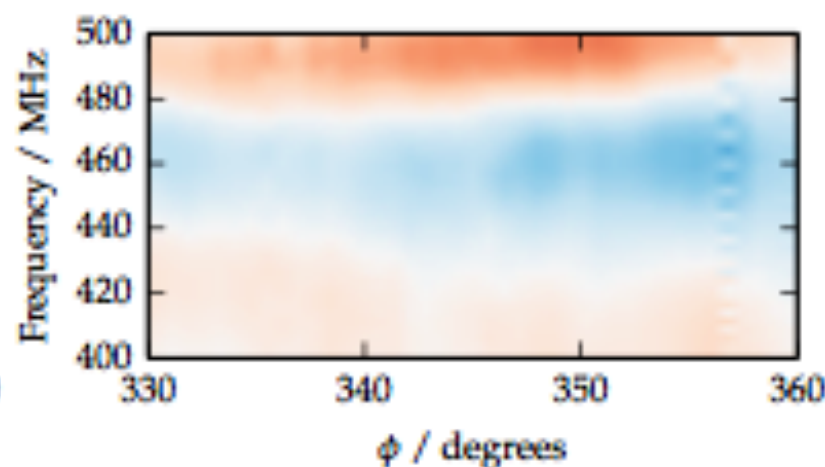
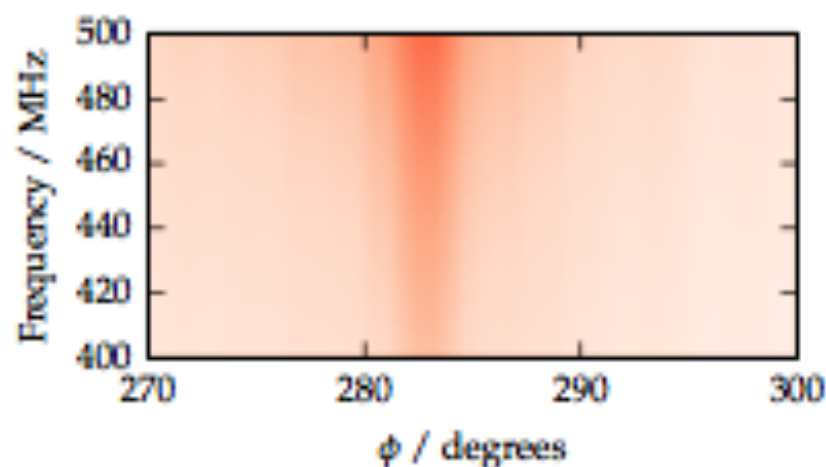
Polarised Foreground (Q)



21cm Signal



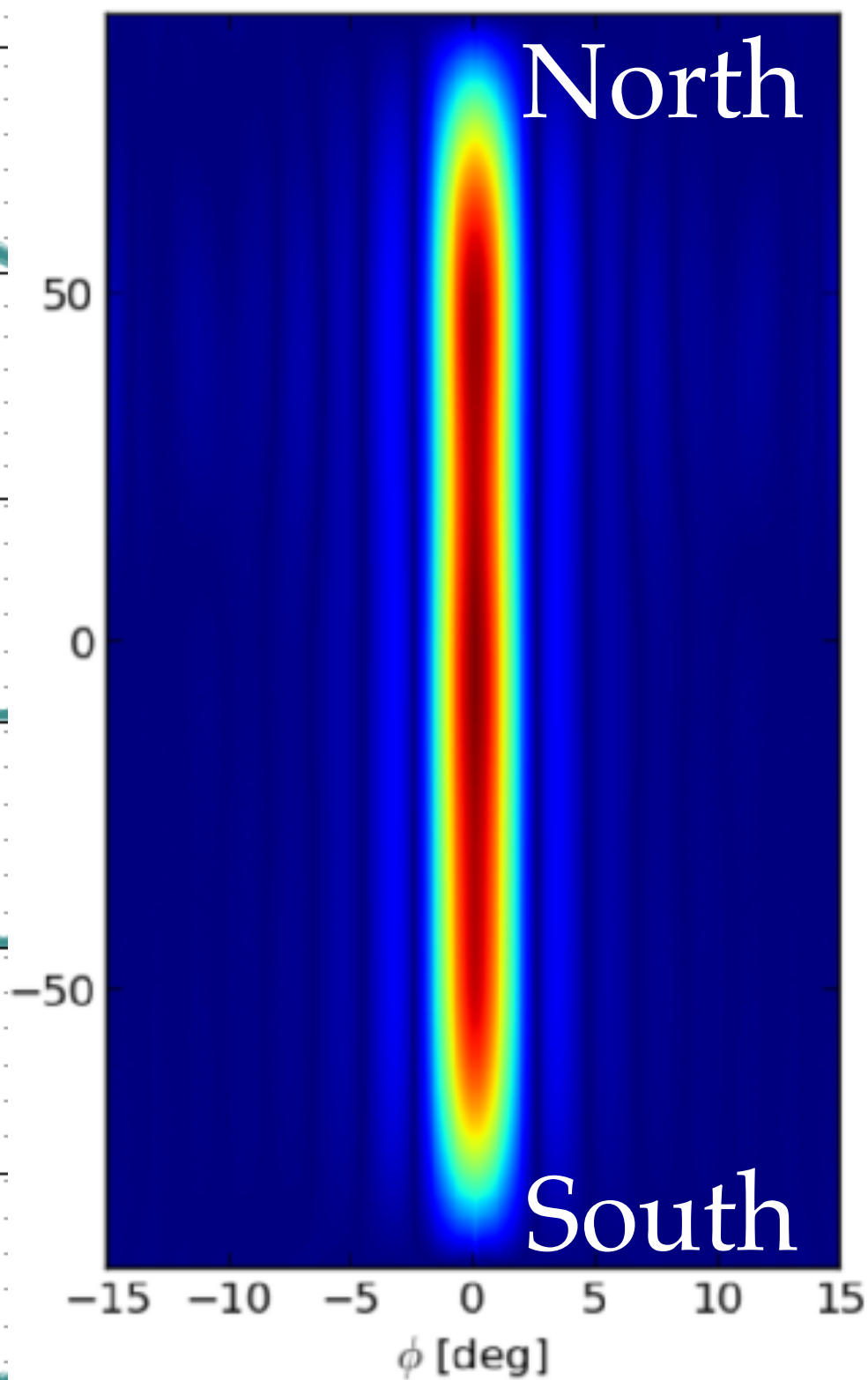
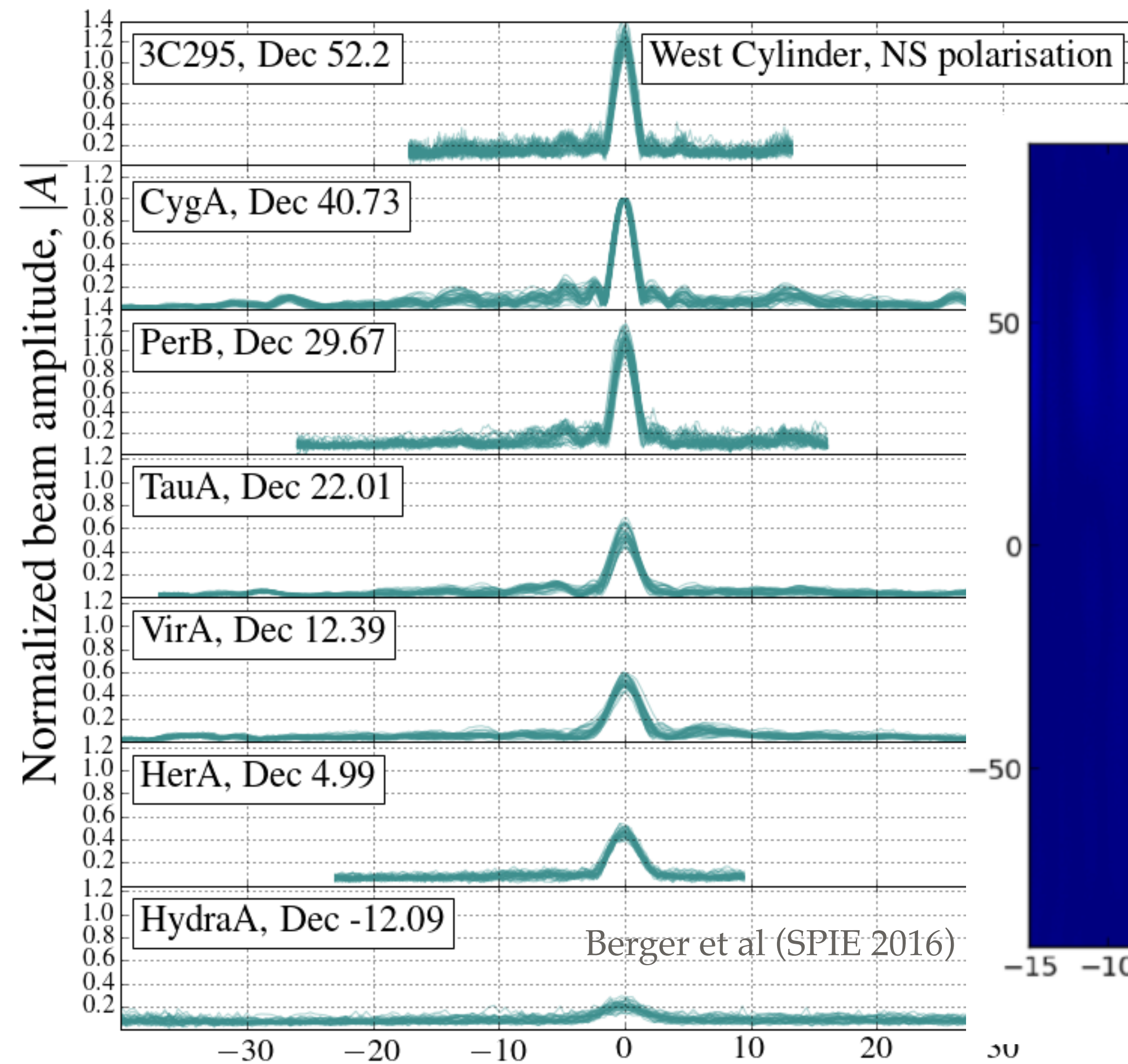
Shaw et al 1401.2095



Require: $<1\%$ gain error
 $<0.1\%$ beam error

750 K

140 μ K



Adrian asked me to talk about 3 things:

Post-LSST??

But its post-everything!

- ❖ LSST
- ❖ CHIME
- ❖ HERA
- ❖ CMB-S4



So we'll know the answer to:

Dark Energy

Neutrino mass

of relativistic species

Reionization

But its post-everything!

- ❖ LSST
- ❖ CHIME
- ❖ HERA
- ❖ CMB-S4



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Measure all the modes!

Modified gravity vs Dark Energy

Non-Gaussianity (inflation)

Current Beam Measurements

